**CS 219**

**Assignment #1**

Purpose: Become familiar with basic architecture and computer abstractions (Chapter 1)

Points: 100

**Reading:** Chapter 1

**Assignment:**

Answer the below questions. Responses must be submitted in writing via the class web site. Must use “.pdf” format.

1. Define the following terms: [10 pts]
   1. response time
      1. How long it takes to do a task.
   2. throughput
      1. total work done per unit of time
   3. CPU Time
      1. Time spent processing a given job
2. Compare Von Neumann and Harvard architecture. [10 pts]
   1. Von Neumann allows the the memory to store all elements of a program.
   2. Harvard sperates the memory between instructions and

1. What are the 5 key components of a computer? [5 pts]
   1. CPU
   2. Main Memory
   3. Secondary Memory
   4. MotherBoard
   5. Input output

1. Explain the five classic components of a computer in detail with the diagram. [10 pts]

1. If computer A runs a program in 30 seconds and computer B runs the same program in 10 seconds, explain which computer is faster than other? [5pts]
   1. Computer B
2. What are the eight great ideas of Computer Architecture? Explain each idea in detail. [10 pts]

1. Our favorite program runs in 10 seconds on computer A, which has a 3 GHz clock. We are trying to help a computer designer build a computer, B, which will run this program in 5 seconds. The designer has determined that a substantial increase in the clock rate is possible, but this increase will affect the rest of the CPU design, causing computer B to require 1.4 times as many clock cycles as computer A for this program. What clock rate

should we tell the designer to target? [10 pts]

1. Suppose we have two implementations of the same instruction set architecture. Computer A has a clock cycle time of 500 ps and a CPI of 2.0 for some program, and computer B has a clock cycle time of 1000 ps and a CPI of 1.5 for the same program. Which computer is faster for this program and by how much? [10 pts]

1. Consider three different processors P1, P2, and P3 executing the same instruction set with clock rates and CPI's given in the following table.

|  |  |  |
| --- | --- | --- |
| **Processor** | **Clock Rate** | **CPI** |
| P1 | 2.5 GHz | 1.5 |
| P2 | 3 GHz | 1 |

* 1. Which processor has the highest performance? [5 pts]

* 1. If the processors each execute a program in 15 seconds, find the number of cycles and the number of instructions for each. [5 pts]

* 1. We are trying to reduce the execution time by 40% but this leads to an increase of 25% in the CPI. What clock rate should we have to get this time reduction?
     1. pts]

1. Consider two different implementations of the same instruction set architecture. There are four classes of instructions A, B, C, and D. The clock rate and CPI of each implementation are given in the following table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Clock Rate** | **CPI Class A** | **CPI Class B** | **CPI Class C** | **CPI Class D** |
| **P1** | 2 GHz | 1 | 2 | 3 | 4 |
| **P2** | 2.5 GHz | 2 | 3 | 1 | 2 |

* 1. Given a program with 106 instructions divided into classes as follows: 30% class A, 10% class B, 30% class C, and 30% class D, which implementation is faster?
     1. pts]

* 1. What is the global CPI for each implementation? [5 pts]

* 1. Find the clock cycles required in both cases. [5 pts]